Pacific Science (1989), vol. 43, no. 4

Vertical Distribution of Mollusks on the Rocky Intertidal of Easter Island[1]

CECILIA OSORIO AND VICTOR CANTUARIAS[2]

ABSTRACT: Horizontal and vertical distribution of mollusks was studied in the rocky intertidal of Easter Island (27°09′ S, 109°26′ W) in January and again in September 1986. Organisms are zoned from the upper to the lower intertidal. In the upper horizon dominant species are *Nodilittorina pyramidalis pascua*, *Rehderella belyaevi*, *Nerita* sp., and *Planaxis akuana*, together with crustaceans, decapods and echinoderms. In the middle horizon dominant species are *Plaxiphora mercatoris*, *Dendropoma* sp., *Antisabia* sp., and *Pilosabia* sp. Mid-horizon pools support algae; the only relatively abundant coral, *Porites lobata*; numerous gastropods such as *Stomatella* and *Euplica*; crustaceans; and echinoderms. In the lowest horizon *Cypraea caputdraconis* and *Echinometra insularis* are dominant. The latter species is a rock borer that builds "pots" forming microhabitats shared with other organisms. Some specimens of *Dendropoma*, *Pocillopora*, and *Echinostrephus* were also found in this horizon. No great differences in distribution of organisms among the south, northeast, and northwest sectors of the island were distinguished in an index of similarity. Distribution patterns at Easter Island are comparable with those in other tropical areas where the same families and genera are found. At Easter Island the species are different because of the high degree of endemism among the mollusks.

EASTER ISLAND, or Rapa Nui (lat. 27°09′ S, long. 109°26′ W), a Chilean possession in the southeast Pacific, is one of the most isolated islands in the Pacific Ocean. Its marine fauna is primarily derived from the Indo-West Pacific (Rehder 1980, Ladd 1960, Ekman 1953), but because of its extreme isolation and other conditions typical of the area there is marked endemism among the mollusks. Kohn and Lloyd (1973) found that 67–88% of the corals, crustaceans, gastropods, and fish at Easter Island are also present elsewhere in the Indo-Pacific, and most of the remainder are endemic. Rehder (1980) considers about 42% of the mollusks endemic. Schilder (*fide* Rehder 1980) recognized Easter Island as an independent zoogeographical province and designated it the "Rapanuian" or Easter Island Province.

Easter Island has a temperate to subtropical climate. Monthly average ocean surface temperatures fluctuate between 24°C in summer and 20°C in winter. The extreme temperatures (maximum and minimum recorded temperatures) were 30.6°C (25 December 1964) and 15.6°C (9 August 1979), according to records kept from 1957 to 1978 by the Instituto Hidrografico de la Armada de Chile (Chilean Navy Hydrographic Institute). Because of its close relationship with the Pacific anticyclone (Hauser 1986), the island has rains throughout the year.

The human population of Easter Island is now about 2300. In prehistoric times the island was overpopulated, reaching on average from 10,000 to 15,000 inhabitants. The shoreline perimeter of 57 km (Boonen 1897) is continuously searched by the islanders for food and raw materials for handicrafts.

Most of the scientific literature concerning Easter Island deals with taxonomic and biogeographic problems of different animal groups, e.g., Fuentes (1914), Wells (1972), and Cea and Di Salvo (1982)—corals; Garth (1973)—crabs; Kohn and Lloyd (1973)—polychaetes; Kohn (1978*a*), Pinochet (1980),

[1] Manuscript accepted 12 December 1988.

[2] Departamento de Ciencias Ecológicas, Facultad de Ciencias, Universidad de Chile, Casilla 653, Santiago, Chile.

and Rehder (1980)—mollusks; Fell (1974) and Codoceo (1974)—echinoderms; Randall and McCosker (1975), and Randall (1976)—fishes. Castilla and Rozbaczylo (1987) published a bibliographic review of the littoral marine invertebrates. Santelices and Abbott (1988) discussed algal zonation and biogeography.

Relatively little work has been done on ecology and the distribution of organisms on Easter Island. The aim of this work is to characterize the vertical and horizontal distribution of mollusks in the rocky intertidal, to compare species composition of intertidal mollusks on different sectors of the coastline, and to compare the distribution and composition of the Easter Island intertidal fauna with that in temperate and tropical areas.

MATERIALS AND METHODS

Collections were made on Easter Island from 9 to 16 January and from 11 to 18 September 1986. Average tidal heights during the study periods were 0.82 m and 0.27 m in January and 0.59 and 0.13 m in September. Seven sections of the rocky intertidal were selected for transects (Figure 1): Hanga Roa, Akahanga, Hanga Nui, Vinapu, and Anakena, which are areas of basalt shoreline; and Vaihu and Ovahe, which are beaches.

Mollusks were obtained in transects perpendicular to the coastline at Hanga Roa and Vaihu during low tides. Collections were made on exposed and protected rocks, in crevices, and under rocks and algae. Three biotic zones were established parallel to the shoreline, each delimited by numerically and macroscopically dominant species used as biological indicators.

Sorensen's (1948) index of similarity was used to compare mollusk populations in the different sectors studied. Species collected among rocks and shells found in the work area were included in the calculations.

RESULTS

Distribution

Sixty-four mollusk species were identified (Table 1). Fourteen (22%) of the species were common to five to seven of the seven sectors sampled; 23 (36%) were found in a single area. Thus, 14 species were restricted to Anakena, four to Hanga Roa, three to Hanga Nui, and

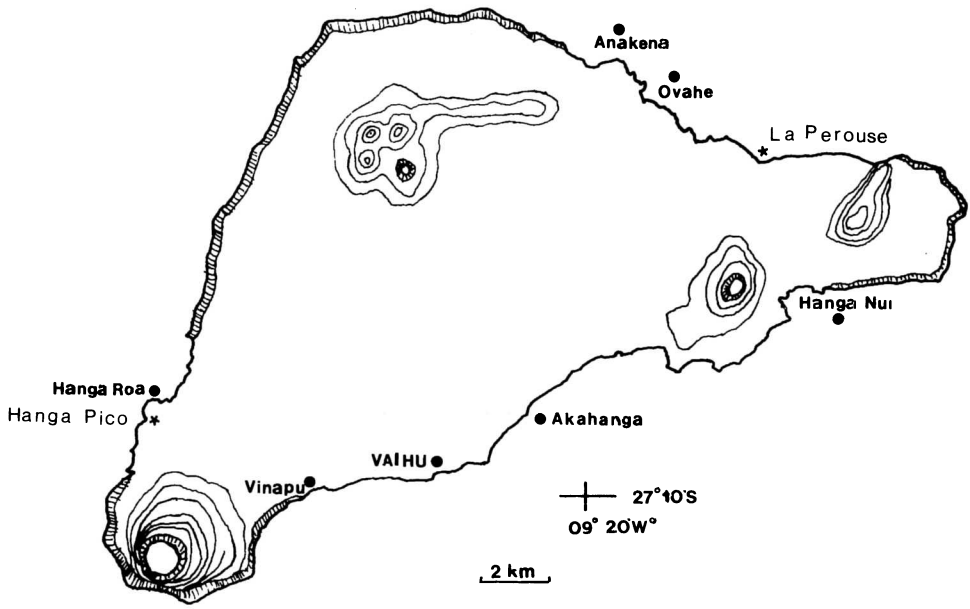

FIGURE 1. Easter Island, showing study areas.

TABLE 1

MOLLUSK SPECIES RECORDED IN THE ROCKY INTERTIDAL OF EASTER ISLAND[a]

SPECIES	VI	AN	HN	OV	HR	VA	AH
Plaxiphora							
mercatoris Leloup*	×		×		×		×
Emarginula							
velascoi Rehder		×	×				
Diadora							
granifera Pease		×	×		×	×	×
Euchelus							
alarconi Rehder*		×	×		×	×	×
Stomatella							
esperanzae Rehder*		×	×		×		
Nerita							
lirellata Rehder*	×	×	×		×		×
morio (Sowerby)	×	×	×	×	×	×	×
Nodilittorina							
pyramidalis pascua Rosewater	×	×	×	×	×	×	×
Rissoina							
turricula englerti Rehder		×	×	×		×	×
Merelina							
crassula Rehder	×	×	×				
Zebina							
tridentata crassilabrum (Garrett)*			×		×	×	
Assiminea							
vulgaris (Webster)		×	×	×			
Heliacus							
codoceoae Rehder*			×				
Dendropoma							
sp.	×	×	×		×	×	
Caecum							
sp.		×					
Cerithidium							
actinium Rehder		×					
Triphora							
sp.			×				
Planaxis							
akuana Rehder*	×	×	×	×	×	×	×
fasciatus Pease					×	×	
Melanella							
cumingi (A. Adams)					×	×	
Balcis							
aciculata (Pease)		×			×		
Vitreolina							
wareni Rehder*		×					
Epitonium							
pyramis Tinker		×					
Hemiliostraca							
bahamondei Rehder*		×					
Antisabia							
foliacea (Quoy and Gaimard)		×	×		×	×	×
imbricata (Gould)		×	×		×	×	×
Pilosabia							
trigona (Gmelin)		×			×		×
Fossarus							
cumingii A. Adams			×			×	×
Strombus							
maculatus Sowerby		×				×	
Trivirostra							
pellucidula (Reeve)		×					

TABLE 1 (continued)

SPECIES	VI	AN	HN	OV	HR	VA	AH
Cypraea							
caputdraconis Melvill*	×	×	×	×		×	
englerti Summers and Burgess*							×
Morula							
praecipua Rehder*					×		
Neothais							
nesiotes Iredale	×	×	×	×	×	×	×
Pascula							
citrica (Dall)*						×	×
Zafrona							
pusilla Pease*			×		×		
Euplica							
loisae Rehder		×	×		×	×	
Seminella							
ornata (Pease)*		×				×	
Nodochila							
pascua (Hertlein)*		×	×		×	×	
Caducifer							
decapitata englerti Hertlein*		×	×		×	×	×
Mitra							
flavocingulata Lamy*		×					×
Granula							
pascuana Rehder*						×	
Lienardia							
exilirata Rehder*			×	×		×	
Conus							
miliaris pascuensis Rehder*	×	×	×		×	×	×
Acuminia							
venosa (Hinds)		×					
Egentelaria							
stylata (Hinds)		×					
Retusa							
pusilla (Pease)						×	
Smaragdinella							
calyculata (Broderip and Sowerby)			×				
Siphonaria							
pascua Rehder*	×	×		×	×	×	
Williamia							
radiata Rehder		×					
Melampus							
pascus Odhner*	×	×	×	×		×	×
Trimusculus							
odhneri (Hubendick)					×		
Rangitotoa							
sp.*				×			
Aplysia							
sp.		×			×	×	
Nudibranchia							
sp.						×	
Modiolus							
matris Pilsbry		×					
Septifer							
bryanae (Pilsbry)						×	
Barbatia							
nuttingi (Dall)		×	×				
Codakia							
bella (Conrad)		×	×		×	×	
Chlamys							
pasca Dall*		×					

TABLE 1 (continued)

SPECIES	VI	AN	HN	OV	HR	VA	AH
Lasaea							
hawaiensis Dall			×		×	×	
Semele							
australis (Sowerby)					×	×	×
Tellina							
mauia Dall		×					
Mactridae							
sp.		×					

[a]Abbreviations of sectors selected for transects: VI, Vinapu; AN, Anakena; HN, Hanga Nui; OV, Ovahe; HR, Hanga Roa; VA, Vaihu; AH, Akahanga.
*Indicates endemic species.

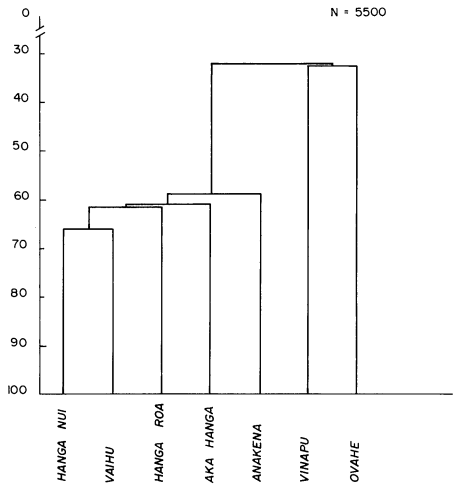

FIGURE 2. Dendrograph showing indices of similarity for the molluscan fauna of the seven sampled sectors on Easter Island.

two to Vaihu. Eighteen species representing other phyla were found with the mollusks.

The Sorensen similarity index shows that five sectors exhibited more than 50% similarity (Figure 2). Greatest similarity was between Hanga Nui and Vaihu (67%), and Hanga Nui, Vaihu and Hanga Roa, and Akahanga (62–63%). In contrast, Vinapu and Ovahe showed less similarity with the above areas (34%) and both showed a low index (35%).

The results obtained from the transects of vertical distribution of the mollusks of the rocky intertidal are shown in Figure 3. Hanga Roa and Vaihu, both areas with gradual slopes, basaltic volcanic rock of similar composition, littoral pools, and patches of coral, are the most similar of the areas sampled.

Zonation

From the high-tide line to the low-tide line, organisms are arranged in horizons or zones parallel to the coastline. These horizons are characterized by certain macrospecies that are dominant in number in each of the horizons, but that actually form a biological continuum from the high-tide line to the low-tide line. Three typical horizons are described.

The dominant species in the upper horizon were the gastropod *Nodilittorina pyramidalis pascua* and the barnacle *Rehderella belyaevi* Zevina and Kurshakova. *Nodilittorina* (mean length, 11.9 mm) reached an abundance of 304 specimens per square meter in certain sites. The other dominant component, the balanid *Rehderella*, covered an average of 26% of the rock surface. At the lower reaches of the upper horizon, the nerites *Nerita morio* and *N. lirelata* increased in abundance both on and under rocks. As many as 52 specimens per square meter were counted. In the lower part of the upper horizon, under rocks, small specimens (mean length, 5.9 mm) of *Planaxis akuana* (724 specimens per square meter) were found, together with *Nerita*, the crab *Cyclograpsus longipes* Stimpson, and the brittle star *Ophiocoma dentata* Muller and Troschel. An average of 84 specimens of varying sizes of *Ophiocoma* were counted per square meter. The brittle star preys on the gastropod *Planaxis*.

In the middle horizon the dominant orga-

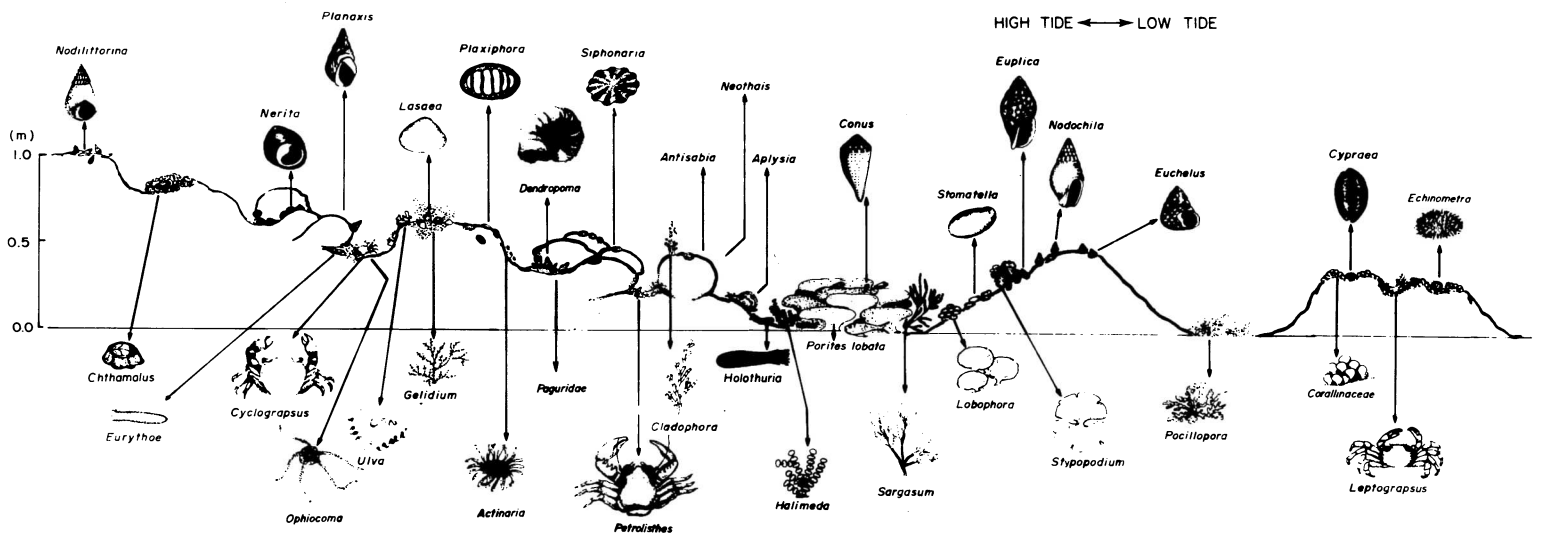

FIGURE 3. Vertical distribution of mollusks and associated organisms in the rocky intertidal of Easter Island.

nisms were the chiton *Plaxiphora* and the coral *Porites*, and mollusks were less conspicuous than the algae *Ulva lactuca*, *Cladophora* sp., and *Gelidium* sp. The only live-collected bivalve, *Lasaea*, was found on fronds of *Gelidium*. The gastropod *Dendropoma* sp. was found cemented to the substrate. *Plaxiphora* was relatively abundant in crevices, and a maximum number of 24 specimens per square meter was recorded. The errant polychaete *Eurythoe complanata* (Pallas) and crabs such as *Petrolisthes coccineus* (Owen) and xanthids were found under the rocks.

The most conspicuous component of the pools in this zone was the coral *Porites lobata*. Small fish and eels (Moringuidae and Muraenidae) were seen under the coral heads. There was also a great abundance of algae such as *Sargassum skottsbergii*, *Lobophora variegata*, and *Halimeda opuntia* in the pools. Specimens of the gastropods *Conus*, *Euchelus*, *Euplica*, *Neothais*, *Nodochila*, *Stomatella*, and *Strombus*, and, occasionally, individuals of *Aplysia* sp. (up to 800 g) were found among the algae. Another important biological component of this horizon was the sea cucumbers *Holothuria difficilis* and *H. cinerascens*, which were found on the bottom of the pools at mean densities of $70/m^2$. Other organisms attached to the substrate included Actinaria and the hipponicid gastropods *Antisabia* and *Pilosabia*.

At the lowest horizon, the most typical macrocomponent was the sea urchin *Echinometra insularis* Clark. This echinoid is a rock borer and builds marine "pots." Mean densities of 17 specimens per square meter were recorded. Fifty-four percent of the "pots" contained other organisms such as pagurid crabs, nerites, polychaetes, turbellarians, small specimens of *Plaxiphora*, and *Neothais*. In the remaining 46% of the cavities, only *Echinometra* was found. The gastropod *Cypraea caputdraconis* was collected in cavities. Crustose algae were found on rocks in neighboring areas. When density of echinoids is low (less than $10/m^2$), algal cover increases. A few specimens of *Dendropoma*, *Pocillopora*, and *Echinostrephus* sp., another rock borer, were also recorded in this horizon.

DISCUSSION AND CONCLUSIONS

The distribution of the 64 identified species of gastropods in the intertidal of Easter Island, and especially those of *Nodilittorina*, *Cypraea*, *Plaxiphora*, and *Planaxis*, support Rehder's (1980) conclusions on distribution. Thirty-nine percent of the intertidal mollusks recorded are endemic, a figure close to that of Rehder's (1980) 42% for overall mollusk endemism. The high proportion of mollusks endemic to the intertidal on Easter Island also supports Vermeij's (1972) hypothesis that high intertidal organisms are specifically adapted to the morphological and physiological requirements of the physical regime in which they live. Neritids and littorinids, for example, are particularly adapted to high temperature and stresses of desiccation.

Generally speaking, the pattern of distribution of the mollusks sampled is relatively homogeneous on the south, northeast, and northwest sectors of the island. The relatively low similarity index (35%) for two sectors of the island, Ovahe and Vinapu, compared with an average index of 63% for the other five areas, may be influenced by the topographic characteristics of the sites, or can perhaps be explained in terms of habitat (Kay 1979). Ovahe is a beach where rocks alternate with sandy areas, and the water in the intertidal has a high sediment content that may hinder settlement on rocks. Vinapu is a narrow beach with smooth, rounded edges. The physical characteristics of both sectors are such that only a limited number of organisms can survive in these areas, where, as suggested by Eleftheriou and Nicholson (1975), physical disturbance and severe hydrodynamic conditions provoke sediment instability.

The rocky intertidal is well known for zonation, the arrangement of communities parallel to the coastline (Menge and Lubchenko 1981). Easter Island is no exception, although zonation is less obvious in some sectors of the island than in others, as has been reported for Taboguilla, Panama (Lubchenko et al. 1984).

The occurrence of some mollusks can be explained by the occurrence of certain types of habitat such as substrate or the occurrence of

algae. Some organisms are found only on basalt shores (Vermeij 1971). Others are found only where algae are abundant, as is *Aplysia*, the stomach contents of which include intertidal algae such as *Hypnea*, *Laurencia*, and *Sphacelaria* (M. E. Ramirez, pers. comm.).

The occurrence of corals in the intertidal is remarkable. Scarce and isolated, corals do not form reefs around the island, probably because seawater temperatures are below the minimum tolerated by reef-building corals (Wells 1972), and perhaps also because of the isolation of the islands, the limited number of habitats (Randall and McCosker 1975), and the rugged tectonic features and problematic oceanographic climate (Di Salvo 1985).

Several food webs have been identified in the rocky intertidal at Easter Island. Polychaete, sipunculid, and gastropod food webs were recorded by Kohn (1978*b*), who identified *Mitra flavocingulata* preying on sipunculids; *Neothais nesiotes* feeding on *Rehderella belyaevi*, *Antisabia imbricata*, and *Dendropoma* sp.; and *Pisania decapitata englerti* preying on polychaetes. *Planaxis*, with abundances typical of those reported by Houbrick (1987), is preyed on by large numbers of *Ophiocoma*. It is worth noting that *Conus miliaris* at Easter Island (Kohn 1978*a*) has a microhabitat distribution in the intertidal of the western Indo-Pacific similar to that at Easter Island, reaching the same depths. Most specimens are found associated with algae, although *Conus* feeds on polychaetes.

Comparison of the organisms present at Easter Island and those of rocky intertidal areas in the tropical Pacific and on the coasts of the Americas is shown in Table 2. As has been pointed out by Vermeij (1971, 1973), Vermeij et al. (1983), and Kay (1979), the same families and genera of mollusks, barnacles, echinoids, and corals occur in tropical waters around the world, but the species are different. At Easter Island, the species are noticeably different because of the high percentage of endemism among the mollusks. The fauna of Easter Island also differs in that fewer species of mollusks occur in intertidal than are recorded elsewhere: 14 molluscan species were recorded at Easter Island in contrast to an average of 20 in the tropical American intertidal areas and an average of 30 in the intertidal areas of the Hawaiian Islands and the northern Marianas. This finding is consistent with that of Santelices and Abbott (1988), who recorded relatively few species of algae in the intertidal. It is also noteworthy that members of the family Mytilidae do not form conspicuous mats as they do in Hawaii and Pernambuco (Kay 1979, Vermeij and Porter 1971).

Although the population of Easter Island is relatively small, the island has a long history of human habitation, and the effects of that history are apparent. Cowries, for example, are virtually limited to the lowest horizon of the intertidal, but the occurrence of two specimens in the middle horizon suggests that the distribution of *Cypraea caputdraconis* is, or has been, wider than it is today.

ACKNOWLEDGMENTS

We thank professors N. Bahamonde, D. Soto, and E. Valenzuela for valuable suggestions and help with revision of the manuscript; L. Di Salvo for references; M. E. Ramirez, N. Rozbaczylo, and M. Codoceo for identifying algae, polychaetes, and holothurians, respectively; L. Gonzalez, E. Villouta, A. San Martin, T. Pakarati, and A. Rirorroco for help in the field; C. Fernadez for diagrams; M. Bustos for technical assistance; and M. Cariceo for typing. This work was supported financially by the Departamento Tecnico de Investigación, Universidad de Chile.

LITERATURE CITED

BOONEN, J. 1897. Isla de Rapa Nui o de Pascua. Ensayo sobre Geografía Militar de Chile. Tomo II. Imprenta Cervantes.

CASTILLA, J. C., and N. ROZBACZYLO. 1987. Invertebrados marinos de Isla de Pascua y Sala y Gomez. Pages 191–215 *in* J. C. Castilla, ed. Islas Oceánicas Chilenas. Ed. Univ. Catolica de Chile.

CEA, E. A., and L. H. DI SALVO. 1982. Mass expulsion of Zooxanthellae by Easter Island corals. Pac. Sci. 36:61–63.

TABLE 2

MOLLUSCAN SPECIES COMPOSITION OF THE INTERTIDAL OF EASTER ISLAND AND SOME TROPICAL AMERICAN AREAS AND PACIFIC ISLANDS GROUPS

EASTER ISLAND	FLORIDA KEYS (Stephenson and Stephenson 1950)	MARGARITA ISLAND, VENEZUELA (Rodriguez 1959, 1967)	TABOGUILLA ISLAND, PANAMA (Lubchenko et al. 1984)	HAWAIIAN ISLANDS (Kay 1977, 1979)	NORTHERN MARIANA ISLANDS (Vermeij et al. 1983)
Upper Horizon					
Nodilittorina pyramidalis pascua				*Nodilittorina hawaiensis*	*Nodilittorina pyramidalis millegrana*
	Littorina ziczac	*Littorina ziczac*	*Littorina aspera modesta*	*Littorina pintado*	
Nerita lirellata morio	*Nerita peloronta versicolor*	*Nerita peloronta versicolor*	*Nerita funiculata scabricosta*	*Nerita picea*	*Nerita albicilla guamensis insculpta maxima plicata*
				Theodoxus neglectus	
	Tectarius tuberculatus	*Tectarius muricatus*			
Planaxis akuana	*Planaxis lineatus*			*Planaxis labiosa*	*Planaxis niger zonatus*
	Echininus nodulosus				
			Acanthina brevidentata		
	Melampus flavus coffeus				
	Detracia bulloides				
Rehderella belyaevi		*Tetraclita* sp.			
				Onchidium verraculatum	

TABLE 2 (continued)

EASTER ISLAND	FLORIDA KEYS (Stephenson and Stephenson 1950)	MARGARITA ISLAND, VENEZUELA (Rodriguez 1959, 1967)	TABOGUILLA ISLAND, PANAMA (Lubchenko et al. 1984)	HAWAIIAN ISLANDS (Kay 1977, 1979)	NORTHERN MARIANA ISLANDS (Vermeij et al. 1983)
Middle Horizon	*Diodora listeri*				
		Fissurella nimbosa	*Fissurella virescens*		
					Haliotis varia
				Cellana exarata	*Cellana toreuma*
					Patella flexuosa
					Notacmaea sp.
					Stomatella planulata
	Nerita tessellata versicolor				
Dendropoma spp.					
					Serpulorbis variabilis
Antisabia foliacea imbricata				*Antisabia foliacea imbricata*	
Pilosabia trigona				*Pilosabia pilosus*	
Neothais nesiotes				*Neothais harpa*	
	Thais rusticus		*Thais melones*	*Thais intermedia*	*Thais armigera intermedia*
				Purpura aperta	*Purpura persica*
				Morula granulata uva	*Morula biconica granulata uva*

TABLE 2 (continued)

EASTER ISLAND	FLORIDA KEYS (Stephenson and Stephenson 1950)	MARGARITA ISLAND, VENEZUELA (Rodriguez 1959, 1967)	TABOGUILLA ISLAND, PANAMA (Lubchenko et al. 1984)	HAWAIIAN ISLANDS (Kay 1977, 1979)	NORTHERN MARIANA ISLANDS (Vermeij et al. 1983)
				Drupa *morum* *ricina*	*Drupa* *morum* *ricina* *rubusidaeus*
	Cantharus *tinctus* *Onchidium* *floridianum*				
				Smaragdinella *calyculata*	*Smaragdinella* *calyculata*
Siphonaria *pascua*	*Siphonaria* *alternata* *pectinata*		*Siphonaria* *gigas*	*Siphonaria* *normalis*	*Siphonaria* *sirius* cf. *guamensis*
Melampus *pascua*					
	Mytilus *exustus*	*Perna* *perna*	*Brachidontes* *semilaevis* *Modiola* *capax*	*Brachidontes* *crebristriatus*	
	Isognomon *alata* *chemnitziana*		*Ostrea* spp. *Ceratozona* sp.		
Plaxiphora *mercatoria*	*Acanthopleura* *granulata*		*Chiton* *stokesi*	*Acanthochiton* *armata* *viridis*	*Acanthochiton* *gemmata*
	Chthamalus *stellatus* *Tetraclita* *squamosa*				
Lower Horizon *Diodora* *granifera*	*Diodora* *antillarum*	*Diodora* sp. *Fissurella* *nimbosa*	*Fissurella* *longifissa* *virescens*	*Diodora* *granifera*	*Diodora* *granifera*

TABLE 2 (continued)

EASTER ISLAND	FLORIDA KEYS (Stephenson and Stephenson 1950)	MARGARITA ISLAND, VENEZUELA (Rodriguez 1959, 1967)	TABOGUILLA ISLAND, PANAMA (Lubchenko et al. 1984)	HAWAIIAN ISLANDS (Kay 1977, 1979)	NORTHERN MARIANA ISLANDS (Vermeij et al. 1983)
				Cellana sandwicensis	
	Tegula fasciata				
Cypraea caputdraconis	*Strombus gigas*			*Cypraea caputserpentis*	*Cypraea caputserpentis*
				Petaloconchus keenae	
		Thais haemastoma	*Thais melones*		
			Acanthina brevidentata		
			Siphonaria maura		
	Arca barbatia umbonata		*Chama echinata*	*Chama iostoma*	
				Isognomon incisum	*Isognomon incisum*
	Ischnochiton limaciformis	*Chiton tuberculatus*	*Tonicia forbesi*		
Porites lobata	*Porites* spp.	*Porites* sp.			
Pocillopora sp.	*Millepora* sp.	*Acropora* sp.	*Pocillopora damicornis*	*Pocillopora meandrina*	*Pocillopora meandrina*
		Meandrina sp.			
			Balanus inexpectatus		
			Chthamalus sp.		
Echinometra insularis	*Echinometra lucunter*	*Echinometra lucunter*	*Echinometra vanbranti*	*Echinometra mathaei*	*Echinometra* sp.

CODOCEO, R. M. 1974. Equinodermos de la Isla de Pascua. Bol. Mus. Nac. Hist. Nat. Santiago Chile 33:53–64.

DI SALVO, L. H. 1985. Ecological observations on the Easter Island sublittoral. Abstract. Fifth Int. Coral Reef Congress, Papeete, Tahiti.

EKMAN, S. 1953. Zoogeography of the sea. Sidwick & Jackson, London.

ELEFTHERIOU, A., and M. D. NICHOLSON. 1975. The effects of exposure on beach fauna. Cah. Biol. Mar. 16:695–710.

FELL, F. J. 1974. The echinoids of Easter Island (Rapa Nui). Pac. Sci. 28:147–158.

FUENTES, F. 1914. Contribución al estudio de la fauna de Isla de Pascua. Bol. Mus. Nac. Hist. Nat. Santiago Chile 7:5–37.

GARTH, J. S. 1973. The brachyuran crabs of Easter Island. Proc. Calif. Acad. Sci. 39: 311–336.

HAUSER, Y. A. 1986. Una alternativa de abastecimiento de agua para Hanga Roa, Isla de Pascua, V Región. Chile. Serv. Nac. Geol. Min. Misc. 5:1–14.

HOUBRICK, R. S. 1987. Anatomy, reproductive biology and phylogeny of the Planaxidae. Smithson. Contrib. Zool. 445:1–50.

KAY, E. A. 1977. Introduction. Pages 4–11 *in* D. Devaney and L. G. Eldredge, eds. Reef and shore fauna of Hawaii. Section 1: Protozoa through Ctenophora. Bernice P. Bishop Mus. Spec. Publ. 64(1).

———. 1979. Reef and shore fauna of Hawaii. Section 4: Mollusca: Hawaiian marine shells. Bernice P. Bishop Mus. Spec. Publ. 64(4): 1–12.

KOHN, A. J. 1978*a*. Ecological shift and release in an isolated population of *Conus miliaris* at Easter Island. Ecol. Monogr. 48: 323–336.

———. 1978*b*. Gastropods as predators and prey at Easter Island. Pac. Sci. 32:35–37.

KOHN, A. J., and M. C. LLOYD. 1973. Marine polychaete annelids of Easter Island. Int. Rev. Gesamten Hydrobiol. 58:687–708.

LADD, H. S. 1960. Origin of the Pacific Island molluscan fauna. Am. J. Sci., Bradley Volume 258-A:137–150.

LUBCHENKO, J., B. A. MENGE, S. D. GARRITY, P. J. LUBCHENKO, L. R. ASHKENAS, S. D. GAINES, R. EMLET, J. LUCAS, and S. STRAUSS. 1984. Structure, persistence and role of consumers in a tropical rocky intertidal community (Taboguilla Island, Bay of Panama). J. Exp. Mar. Biol. Ecol. 78:23–73.

MENGE, B. A., and J. LUBCHENKO. 1981. Community organization in temperate and tropical rocky intertidal habitats: Prey refuges in relation to consumer pressure gradients. Ecol. Monogr. 51:429–450.

PINOCHET, C. E. 1980. Gastropodos en la Isla de Pascua y seis especies marinas de otras clases. An. Univ. Chile 161–162:161–181.

RANDALL, J. E. 1976. The endemic shore fishes of the Hawaiian Islands, Lord Howe Island, and Easter Island. In Colloque Commerson, La Reunion, 1973. Trav. Doc. ORSTOM 47:49–73.

RANDALL, J. E., and J. E. MCCOSKER. 1975. The eels of Easter Island with a description of a new moray. Contrib. Sci. Nat. Hist. Mus. Los Angeles 264:1–32.

REHDER, H. A. 1980. The marine mollusks of Easter Island and Sala y Gomez. Smithson. Contrib. Zool. 289:1–167.

RODRIGUEZ, G. 1959. The marine communities of Margarita Island, Venezuela. Bull. Mar. Sci. Gulf Caribb. 9(3): 237–280.

———. 1967. Las comunidades bentónicas. Ecología Marina. Fund. La Salle. Venezuela.

SANTELICES, B., and I. A. ABBOTT. 1988. Geographic and marine isolation. An assessment of the marine algae of Easter Island. Pac. Sci. 41:1–20.

SORENSEN, T. 1948. A method of stabilizing groups of equivalent amplitude in plant sociology based on the similarity of species content and its application to analysis of the vegetation on Danish commons. Biol. Skr. 5(4): 1–34.

STEPHENSON, T. A., and A. STEPHENSON. 1950. Life between the tide-marks of North America. I. The Florida Keys. J. Ecol. 38: 354–402.

VERMEIJ, G. J. 1971. Substratum relationship of some tropical Pacific intertidal gastropods. Mar. Biol. 10:315–320.

———. 1972. Endemism and environment: Some shore mollusks of the tropical Atlantic. Am. Nat. 106(947): 89–101.

———. 1973. Morphological patterns in high-intertidal gastropods: Adaptive strategies and their limitations. Mar. Biol. 20:319–346.

VERMEIJ, G. J., and J. W. PORTER. 1971. Some characteristics of the dominant intertidal mollusks from rocky shores in Pernambuco, Brazil. Bull. Mar. Sci. 21(2): 440–454.

VERMEIJ, G. J., E. A. KAY, and L. G. ELDREDGE. 1983. Mollusks of the Northern Mariana Islands, with special reference to the selectivity of oceanic dispersal barriers. Micronesica 19(1–2): 27–55.

WELLS, J. W. 1972. Notes on the Indopacific scleractinian corals from Easter Island. Pac. Sci. 26:183–190.